Thermal Investigations of Polyaniline/Carbon Nanotubes (PANI/CNT) Composites using Photoinduced Thermoelectric Signal

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A thermoelectric (TE) material is a material where a potential difference is generated as a result of a temperature difference. Traditionally, thermoelectric materials are inorganic semiconductors which have been limited in their application by low efficiency and high cost. Recently, an increasing number of studies have concerned polymer-inorganic thermoelectric nanocomposite materials. These systems are very attractive as they are light and generally require relatively simple manufacturing processes compared to semiconductor based thermoelectrics. The composite material consists of inorganic TE nanostructures embedded in a polymer matrix such that the TE properties of the composite are greater than the pure polymer. The fundamental problem in creating efficient TE materials is that they must have a very high electrical conductivity and low thermal conductivity. Hence, the main focus of research on TE materials is to improve electrical conductivity without increasing the thermal conductivity. In this work, thermal parameters (thermal diffusivity, thermal conductivity and thermal effusivity) of Polyaniline (PANI) filled with oxidized and unoxidized carbon nanotubes (single-walled,SWNT or multiple-walled, MWNT) have been measured. We have developed a new method for thermal measurements on TE materials. The thermal parameters are obtained from analysis of the phase or the amplitude of the thermoelectric signal generated by the sample itself when it is periodically heated by a laser beam.